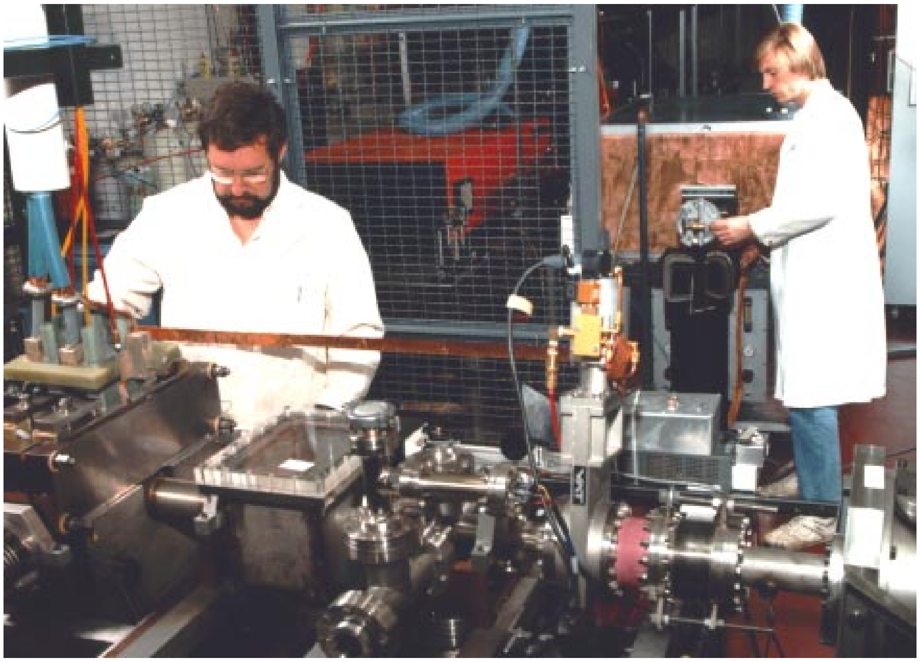

X-ray microscopy bridges gaps in present technologies because it provides better resolution than optical microscopy and, unlike electron microscopy, allows the examination of live biological specimens. These characteristics make it a valuable tool for medical researchers studying cells like the cancer cell at left.

In soft X-ray contact microscopy, samples are placed in contact with a high-resolution recording medium and exposed to X rays. When the medium is developed, a replica of the sample is produced and can be examined with an electron microscope. A new soft X-ray imaging microscope now being developed will produce an image on a television monitor.

Because most applications require X rays with wavelengths shorter than 18.2 nm, a two-laser approach to pro ducing X-ray lasing action at shorter wavelengths is being explored on the system shown above. One laser produces the plasma column, while a second laser produces shorter-wavelength X-ray emission. This high-power laser uses ultrashort ultraviolet laser pulses, allowing extremely high focused power (about 10^{18} watts per square centimeter) with only modest energy. Wavelengths of 1 to 3 nm should be achievable.

The techniques being developed for contact microscopy are closely related to those of microlithography—used for “printing” integrated circuit patterns on semi conductors. The high-resolution X-ray laser could allow a 100-fold increase in the number of components on a single chip.

In collaboration with Princeton Instruments, Inc., PPPL researchers are exploring the application of charge-coupled devices (CCDs) to the direct imaging of soft X rays. Spe cialized thin-backed CCDs are being tested to determine whether they are sensitive to soft X rays. Incorporating the high sensitivity afforded by CCD imaging into soft X-ray instruments would enhance the effectiveness of these new instruments in a host of applications, including plasma diag nostics, material analysis, X-ray astronomy, and X-ray microscopy.